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# ETIOLOGY OF BRUCELLOSIS AND PRACTICAL MEASURES FOR ITS PROPHYLAXIS AND THERAPY IN THE USSR

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Brucellosis belongs to the group of zoonoses. The control of this infection should be carried out through the mutual efforts of workers in the field of public health and workers at veterinary institutions. The latter must lead a decisive role in carrying out measures for the elimination of brucellosis.

The most important tasks of the veterinary-sanitary service and of organs of public health are detection of brucellosis in smaller farm animals; efforts directed towards the elmination of infection with brucellosis; prevention of the infection of humans from sick animals; and prevention of infection as a result of contact with or consumption of animal products, or raw materials derived from animals.

USSR scientists have made great contributions to the solution of problems connected with the pathogenesis, immunity, prophylaxis, and therapy of brucellosis. They have furnished to practical workers advanced and effective methods for the control of this disease.

Of the three existing types of brucellosis, the most infectious form to human beings is the brucellosis of goats and sheep. The brucellosis of cattle is less dangerous to humans. As far as danger to humans is concerned, the brucellosis of swine occupies an intermediate position between the brucellosis of cattle and the brucellosis of goats and sheep. However, swine brucellosis occurs relatively seldom. Bovine brucellosis may be transmitted to other animals, i. e., horses, camels, dogs, or cats, and these animals in turn may infect humans.

Animals infected with brucellosis eliminate large quantities of brucellae with the aborted fetus, the afterbirth, the membranes, the amniotic liquid, and exudates from the uterus. For that reason brucellar animals are particularly dangerous during abortion, when the fur, litter, soil, and surrounding objects with which the animal comes in contact are contaminated with brucellae. The elimination of brucellae with the milk and urine of brucellar animals, particularly after abortion, may be very extended in time. Some animals eliminate brucellae during 5 to 7 months, or longer. The brucellae may survive up to 3-4 months in manure, soil, and fur contaminated with the excretions of animals.

The infection of humans occurs most frequently in connection with work which involves contact with diseased animals, particularly with sheep or goats. The danger of infection is particularly great when aid is given to animals during abortion or birth.

Infection may occur through contact with the meat of infected animals during slaughtering, quartering of carcasses, and treatment of the meat of diseased animals.

Milkmaids who work with brucellar animals may be infected directly through contact with the animals or through the use of their milk. Cases of human infection have been observed in connection with the skinning of still-born lambs or brucellar lambs which have died; also as a result of the shearing of brucellar sheep and goats, and of the sorting of wool originating from brucellar sheep and goats.

The personnel of animal breeding farms most frequently catch the disease during the spring and summer, which corresponds to the period of abortions and births.

Infection of humans may also take place as a result of the consumption of raw milk derived from brucellar animals and of the consumption of infected dairy products. The greatest danger in this connection arises from the consumption of the raw milk of goats and sheep, as well as from the consumption of fresh sheep cheese (brynza). Raw meat and raw meat products from brucellar animals also may serve as a source of human infection.

Children of all ages are likewise susceptible to infection with brucellosis. The infection takes place when brucellae penetrate the body through the mucous membranes of the mouth, lips, or nose; or through small cuts, scratches, or abrasions of the skin. The microorganisms causing the disease, on penetrating the body of a human being or animal, spread by way of the lymphatic system, first of all infecting the lymph nodes which are located in the vicinity of the site of the inital infection.

When infection with a causative factor of low virulence takes place, for instance with brucellae of the bovine type and also when there is natural immunity or increased resistance acquired as a result of vaccination, the brucellar infection may be confined within a local lymphatic barrier with the result that there is subsequent extinction of the infection.

When the causative factor has a high virulence, the infecting dose is large, and there is absence of the necessary resistance of the organism, the infection, after surmounting the lymphatic barrier, develops into a generalized process, the characteristic traits of which are bacteriemia and localization of brucellae in the lymphatic nodes, liver, spleen, kidneys, and the bone marrow. In human beings bacteriemia may be observed as early as the 5th-8th day after infection. During the first year of infection, bacteriemia persists in 60% of the cases.

It was formerly assumed that brucellosis is a lifelong infection. Soviet investigators (P. F. Zdrodovskiy and members of his group) have demonstrated experimentally that the infection under the influence of the primarily acquired resistance of the organism is transformed into a latent condition and subsequently, as immunity increases, is gradually alleviated. In the majority of cases the infection culminates in a spontaneous recovery, which is accompanied by disappearance of brucellae from the body.

Dissappearance of brucellae from the body does not proceed at the same rate in all cases. The process may take a number of years, particularly when the patients have not been treated during the initial period of the disease.

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Data on the alleviation of the infection proceeding to the point of spontaneous recovery made it possible to establish the presence in brucellosis not only of a nonsterile immunity accompanied by infection but also of a postinfection (sterile) immunity, which is characterized by resistance to reinfection after liberation of the organism from brucellae.

The clinical diagnosis of brucellosis in human beings is difficult. Frequently brucellosis is mistakenly diagnosed as typhoid, rheumatism, malaria, endocarditis, tuberculosis, or some other disease. In such cases the laboratory diagnosis of brucellosis becomes of decisive importance. Most convenient for the diagnosis of brucellosis is the reaction of agglutination (Wright reaction) and the intracutaneous allergy test with brucellin. The agglutination reaction becomes positive in the very beginning of the infection. It may be positive even in hidden forms of the disease. The Wright reaction is specific. A high titer of this reaction is retained during the first year of the disease. After this there is lowering of the titer to complete disappearance of the reaction. To carry out the agglutination reaction, 3-5 cc of blood are extracted with a sterile syringe from the cubital vein and are sent in a sterile test tube to the laboratory.

The allergy test according to Burnet is the most convenient for extensive application. In this test 0.1 of a cc of brucellin is injected intracutaneously into the lower surface of the forearm. When the test is positive, painful edema and reddening are observed. The reaction becomes apparent in 5-6 hours after the injection and may persist up to 3 days. The edemic condition and the pain occur invariably, while the reddening is variable depending upon the pigmentation of the skin and its condition.

The allergy test is completely specific and makes it possible to diagnose the disease in cases where the Wright reaction and the blood culture are negative.

The most precise method of diagnosis is a bacteriological investigation. Blood cultures by seeding blood taken from a vein are successful in the first days of the infection in 30 to 90% of all cases. One may obtain a culture by seeding samples of bone marrow obtained from the breast bone according to M. I. Arinkin's method. Cultures from urine succeed in 50% of the cases, particularly during the first year of the disease.

As far as the clinical aspects of brucellosis are concerned, the incubation period on the average varies from one to 3-5 weeks and occasionally extends longer. The duration of the incubation period depends on conditions under which the infection took place and on the degree of resistance of the organs. Brucellosis, as a rule, sets in gradually.

In some cases brucellosis may take a symptomless course and is recognized only on the basis of sero-allergic reactions. Symptomless forms most frequently occur on infection with bovine brucellosis or swine brucellosis.

On infection with bovine brucellosis and more rarely with ovine brucellosis, the disease may assume the nature of a subacute or chronic infection which proceeds without fever or with brief fever periods during which the temperature rises to 37-38° C. The infected persons complain about headaches, neuralgias, pains in the joints and in the waist. They are unable to continue work in a normal fashion.

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A clinically pronounced course of brucellosis is most frequently encountered on infection with goat and sheep brucellosis. In such cases the disease begins with general indispositions of an indefinite character. Occasionally there is an acute onset of brucellosis. The prodromal period may continue from several days to several weeks (G. P. Rudnev). The disease is distinguished by a great diversity of symptoms and complications, so that it is difficult to classify it according to clinical types.

The most commonly occurring symptom of brucellosis is fever of various types. The duration of the period of fever may be from one to 6 weeks, and occasionally may be longer. The number of fever waves may vary between 2-3 and 6-7 or more. As a rule, brucellosis is accompanied by persistent headaches and profuse debilitating perspiration. The skin is afflicted by various types of rashes: roseolic rash, papulous rash, or a pustule rash; there may be petechia and hemorrhages; occasionally itching dermatoses, desquamation of the epidermis, falling of hair, and brittleness of the nails are observed. The affection of the lymphatic system results in adenites of various localization. Catarrhal bronchites frequently occur and recurrent bronchopneumonia is observed. The pulmonary complications may occasionally simulate tuberculosis.

In chronic brucellosis, modifications of the cardiovascular system often occur. As far as the gastrointestinal tract in concerned, one often encounters reduction of the gastric secretion, constipation, diarrheas, pains in the region of the epigastrium, etc. The spleen is enlarged in 75 to 80% of the cases. The liver is also enlarged in 74% of the cases. For that reason a hepatolienial syndrome often develops. Cellulites and fibrosites of various localization are also often observed. Characteristic for brucellosis are the afflictions of the synovial, and bone and joint systems (bursites, tendovaginites, arthrites, arthralgias, etc.). Particularly frequent are afflictions of the sacroiliac joint. The diseases of the bone and joint system result in painful periostites, spondylites, and osteomyelites of various localization. The most typical symptoms of brucellosis are afflictions of the nervous system: the patients suffer a great deal from neuralgias, arthralgias, ischialgias, myalgias, headaches, insomnia, and other conditions. Various afflictions of the nervous system are encountered in brucellosis in 60-80% of cases. Various neuropsychic changes occur. Complications affecting the eyes are not rare: these complications comprise keratites and iridocyclites. As far as the genital sphere is concerned, orchites frequently develop in men and oophorites, metrites, and endometrites in women. Brucellar abortions are possible. The fatality in brucellosis is not high: it amounts to 2-3%. The duration of the disease is indeterminate.

The therapy of brucellosis is difficult. The selection of the type of therapy depends on the form of the disease and of the general condition of the patient. Patients recover rapidly when they have been subjected to treatment at the very start of the disease and have been given the full course of treatment. Vaccine therapy (intravenous, intramuscular, or subcutaneous) yields the best results during all phases of the disease. Vaccine therapy, particularly intravenous, is frequently accompanied by a pronounced reaction of the organism. For that reason it must be carried out in hospitals. The schedules and doses for the application for brucellosis vaccines differ: they have been described in detail by the Soviet scientists G. P. Rudnev, A. S. Bilibin, G. A. Pandikov, and others.



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Protein therapy and blood transfusions have been widely adopted for the therapy of brucellosis, particularly in cases when the infection takes a flaccid course. These methods can be applied under ambulatory conditions of treatment. Chemotherapy with trypaflavine, collargol, and sulfamide drugs is relatively effective from the therapeutic standpoint and hence is commonly used as an auxiliary method of treatment. Lately, antibiotics (biomycin and levomycetin) have been successfully used for therapy in the acute (septic) phase of brucellosis.

In subacute and chronic cases of brucellosis physical therapy is indicated. Sulfur baths, radon [radioactive] baths, and mud baths yield very good results if complications develop in the synovial system, bones and joints, or peripheral nervous system. This method of treatment is effective only when brucellosis is not accompanied by fever. Patients may be sent to health resorts for treatment no earlier than 3 months after the temperature has become normal provided the liver is not enlarged, the reaction of erythrocyte sedimentation is normal, and the titer of the Wright reaction is low.

As a result of the active efforts of our veterinary, medical, agricultural, and industrial workers the occurrence of brucellosis in the USSR can be completely eliminated.

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